

ATTACHMENT J.4.85

ALARA REVIEW

ED-12-2007

ALARA REVIEW

ED-12-2007

Effective Date: September 30, 1997

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FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

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ISSUE AND REVISION SUMMARY

Revision	Date	Description of Issue or Revision
0	4-25-96	New procedure describing the requirements of the as low as reasonably achievable (ALARA) review process at the Fernald Environmental Management Project (FEMP), initiated by F. Jebens.
1	11-01-96	Revised procedure to include the ALARA Committee charter revisions, initiated by W. Kortier.
2	09-30-97	Revised procedure to include re-engineered Fluor Daniel Fernald (FDF) organization. Initiated by G. C. Olbur.

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1.0 PURPOSE

This procedure establishes how the Fluor Daniel Fernald, (FDF) As Low As Reasonably Achievable (ALARA) committee will review the ALARA analysis of projects/activities. ALARA reviews must be conducted early in the design process, for example, the review should commence with the alignment and be completed as conceptual/preliminary design activities are performed.

2.0 SCOPE

The FDF ALARA committee will review the ALARA analysis of projects/activities at the Fernald Environmental Management Project (FEMP) and periodic submittals from the Radiological Awareness Committee (RAC).

3.0 REFERENCES

- 3.1 RM-0020, "FDF Radiological Control Requirement Manual."
- 3.2 ED-12-4001, "Functional Requirements Document"
- 3.3 ED-12-4003, "Design Criteria Package"
- 3.4 ED-12-4010, "Design Verification"
- 3.5 MS-1021, "Project Management"
- 3.6 ED-12-5001, "Engineering/Construction Document Control"
- 3.7 ED-12-5002, "Engineering Design Change Process"
- 3.8 PCS-012, "Change Control Procedure"

4.0 RESPONSIBILITIES

4.1 Leadership Team

- 4.1.1 Dedicate the resources and personnel to implement the elements of the ALARA Program and ensure that the ALARA process is fully implemented during the planning, design, and execution of a project.

4.2 Radiological Awareness Committee (RAC)

- 4.2.1 Interfaces between management and workers for the continual advancement of ALARA practices and concepts.
- 4.2.2 Submit the developed site ALARA goals to the ALARA committee for endorsement.

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4.0 RESPONSIBILITIES

4.2 Radiological Awareness Committee (RAC)

- 4.2.3 Monitor the site ALARA goals and provide a quarterly status report to upper management and the committee.

4.3 ALARA Committee

- 4.3.1 Perform ALARA Implementation Reviews in accordance with this procedure and other approved site procedures.
- 4.3.2 Ensure that the ALARA Process is implemented during the preliminary design review, when required. Provide technical recommendations to supervisors, planners, schedulers, principle investigators, and design engineers to reduce occupational doses and the spread of radioactive materials.
- 4.3.3 Review and approve ALARA program improvements.
- 4.3.4 Endorse site ALARA goals submitted by the RAC prior to the beginning of each calendar year for subsequent approval by the Office of the President.

4.4 Project/Discipline Engineers

- 4.4.1 Incorporate design features that reduce, control, eliminate, or mitigate exposures to ionizing radiation and prevent the spread of radioactive materials.
- 4.4.2 Support Radiological Control engineers and Environmental Compliance project engineers in the performance of environmental ALARA evaluation. Completed evaluations shall be included in the project design package and project file for record keeping purposes.

5.0 GENERAL

- 5.1 The ALARA philosophy adopted by FDF requires that any exposure to ionizing radiation by general employees, the public, or the environment shall be minimized to the extent that social, technical, economic, practical and public regulatory policy considerations allow. FDF management is committed to reducing radiation exposures by applying ALARA concepts and practices in all activities that cause exposure or have the potential to cause exposure.

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5.0 GENERAL

5.2 ALARA COMMITTEE

5.2.1 The ALARA Committee (See Attachment A) performs the following functions:

- A. ALARA Committee review of projects is accomplished during the technical review of documents prepared in accordance with ED-12-4003 and changes to project designs which may affect dose.
- B. The ALARA Committee shall evaluate and endorse the proposed site ALARA goals and the quarterly status report prepared by the RAC prior to submittal to the Office of the President for approval.
- C. The ALARA Committee shall evaluate and concur with suggestions prepared by the RAC for ALARA Program improvements.

6.0 PREREQUISITES

The Preliminary Hazard Analysis (PHA), Safety Assessment (SA), the Functional Requirements Document (FRD), the project concepts, the ALARA process (See Attachment B), and Performance Grading (PG) of Structures, Systems, and Components (SSC) shall have been completed prior to review by the ALARA Committee.

7.0 PROCEDURE

ALARA COMMITTEE

Sections 7.1 and 7.2 identify the key elements of ALARA Implementation strategy which should be included in the design and to monitor the achieved performance against the desired targets. The review will be documented using the guideline checklists (See Attachment C Checklist) to establish whether the assumptions in the design are correct and to provide feedback for future development of proposals and designs. Section 7.3 provides guidance for the preparation of presentation materials which will be the content of the review.

7.1 DESIGN BASIS

7.1.2 Ensures that the design of new facilities or modifications of old facilities include the following objectives:

- A. Optimization methods shall be used to assure that occupational and environmental exposure is maintained ALARA in developing and justifying facility design and physical controls.

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7.0 PROCEDURE

- B. The design objective for controlling personnel exposure from external sources of radiation in areas of continuous occupational occupancy (2000 hours per year) shall be to maintain exposure levels below an average of 0.5 mrem per hour and as far below this average as is reasonably achievable. Exposure rate goals for potential exposure to a radiological worker shall be developed as part of the Functional Requirements Document (FRD).
 - C. The design will control, reduce, or eliminate releases of airborne radioactive material to the workplace atmosphere, the surrounding environment and in any situation, the inhalation of such material by workers to levels that are ALARA.
- 7.1.3 The design or modification of a facility and the selection of materials shall include features that facilitate operations, maintenance, decontamination, and decommissioning.
 - 7.1.4 The documentation prepared for submittal for review shall show that alternatives were considered, and the proposed solution is reasonable.
 - 7.1.5 Identification of ALARA administrative controls where engineered controls are not reasonable and provide the basis for regulatory compliance shall be provided.

7.2 DESIGN AND CONTROL

- 7.2.1 Ensures that measures have been taken to maintain radiation exposures in controlled areas and releases to the environment as low as is reasonably achievable through facility and equipment design and administrative control. The primary methods used shall be physical design features (e.g., filtration, confinement, ventilation, remote handling, and shielding). Administrative controls and procedural requirements shall be employed only as supplemental methods to time and distance alternatives to control radiation exposure.
- 7.2.2 Ensures that occupational dose Administrative Control Levels (ACLs) have been established as far below the DOE occupational dose limit as is reasonable when commencing a project.
- 7.2.3 Ensures that for specific activities where use of physical design features are demonstrated to be impractical, administrative controls and procedural requirements have been used to maintain radiation exposures and releases to the environment ALARA.

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7.0 PROCEDURE

- 7.2.4 Ensures that documentation submitted for review shows that alternatives were considered, but that they would result in higher exposure, were impractical, or were not reasonable. This documentation includes pertinent information developed using ED-12-4003 and reviewed using ED-12-4010.
- 7.2.5 Ensures that management control for administrative procedures and operating requirements that maintain ALARA design objectives for occupational workers is identified.

7.3 PRESENTATION REQUIREMENTS

PROJECT ENGINEER

- 7.3.1 Utilizing the available information for the Facility/Project and the list of Activities and SSCs generated previously, evaluate in accordance with the ALARA process as shown in Attachment B.
- 7.3.2 Develop a summary description of the technical justification based on conservative assumptions and analyses.

Note: Upon completion of Preliminary (Title I) Design, the Preliminary Design Package including ALARA Evaluations (as required) will be submitted for ALARA Committee review.
- 7.3.3 As the Design develops, identify if any existing information requires previously approved documents to be updated through change control. (See ED-12-5002 and PCS-012, See 3.7 & 3.8)
- 7.3.4 Provide a description of the anticipated improvements in the design. Changes and improvements in the design should be documented and sent to responsible organizations which initially provided design verification and approved the ALARA evaluation.
- 7.3.5 Where key ALARA decisions are dependent upon acquisition of data, the alternate approaches shall identify how thresholds will be defined.
- 7.3.6 Identify how a record will be maintained which indicates the disposition of all changes and improvements.

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8.0 RECORDS

The following records will be generated as a result of this procedure:

- 8.1 Copies of the ALARA Committee actions. (Meeting minutes, goals, reports, etc.)
- 8.2 All other correspondence directing action will be processed per Site Procedure ED-12-5001, "Engineering/Construction Document Control" (See 3.6).

9.0 DRIVERS

- 9.1 RM-0012, "Quality Assurance Program"
- 9.2 RM-0015, "FEMP ALARA Requirements Manual."
- 9.3 RM-0016, "Management Plan"
- 9.4 10 CFR Part 835, "Occupational Radiation Protection"

10.0 DEFINITIONS

- 10.1 Administrative Control Level - A numerical dose constraint established at a level below the regulatory limits to administratively control and help reduce individual and collective dose.
- 10.2 As Low As Reasonably Achievable (ALARA) - An approach to radiological control to manage and control exposures (individual and collective) to the work force and to the general public at levels as low as are reasonable, taking into account social, technical, economic, practical and public policy considerations. As used in this manual, ALARA is not a dose limit but a process that has the objective of attaining doses to the worker, to the general public, or to the environment as far below the applicable controlling limits as is reasonably achievable.
- 10.3 ALARA Committee - A multi-disciplined forum that ensures the programmatic elements of the ALARA program are implemented at the FEMP. The committee consists of a chair, FAM or SE representative from five Functional Areas and advisory members as requested by the committee with subordinate counterparts participating on the Radiological Awareness Committee (RAC).
- 10.4 ALARA Process - A logical method for evaluating alternative operations, processes, and other measures, for reducing exposures to radiation and emissions of radioactive material into the environment, taking into account societal, environmental, technological, economic, practical and public policy considerations to make a judgement concerning the optimum level of protection.

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10.0 DEFINITIONS

- 10.05 Decommissioning - The process of closing and securing a nuclear facility, or nuclear materials storage facility so as to provide adequate protection from radiation exposure and to isolate radioactive contamination from the human environment.
- 10.06 Decontamination - Process of removing radioactive contamination and materials from personnel, equipment or areas.
- 10.07 Effluent - Treated waste water or airborne emissions discharged into the environment.
- 10.08 Engineering Controls (Physical Design Features) - Use of structures, systems, and/or components to reduce dose, airborne emissions, and the spread of radioactive materials using piping, containments, ventilation, filtration, or shielding.
- 10.09 Facilities - Buildings and other structures, their functional systems and equipment, and other fixed systems and equipment installed therein; outside plant, including site development features such as landscaping, roads, walks, and parking areas; outside lighting and communication systems; central utility plants; utilities supply and distribution systems; and other physical plant features.
- 10.10 Occupational Dose - The dose received by a person during employment in which the person's assigned duties involve exposure to radiation and to radioactive material. Occupational dose does not include dose received from background radiation, as a patient from medical practices, from voluntary participation in medical research programs, or as a member of the public.
- 10.11 Optimization methodology - A documented methodology which describes how the factors affecting a protection decision, i.e., social, technical, economic, practical, and public policy, are assigned values to compare detriment and benefit.
- 10.12 Radiological Awareness Committee (RAC) - A committee comprised of individuals from project line supervision that are directly involved in remediation activities and work in areas where radioactive material is stored or handled. The main emphasis of the RAC is to promote the application of ALARA concepts and practices in their respective functional areas.
- 10.13 Reasonable - Considerations utilized during design basis development. Existing administrative controls may already be far below trigger levels such that additional costs for engineered controls would not be considered beneficial or reasonable.

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ATTACHMENT A

ALARA Review Committee

1. AUTHORIZATION

Formal committee to verify that requirements identified under **10 CFR 835** are planned and reviewed and that the requirements under **Subpart K** have been implemented. RM-0015, "ALARA Requirements Manual" specifies functional activities of this committee.

2. MEMBERSHIP

Voting Members

Chair - Operations Team Leader

Engineering Design Functional Area - Provides engineering aspect on design.

S&H Functional Area - Provides safety aspect of requirements.

Construction Functional Area - Provides field work aspect of requirements.

Quality Assurance Functional Area - Provides compliance aspect of requirements.

Environmental Protection Functional Area - Provides compliance aspect of requirements.

Advisory Members (Example)

Facilities/Technical Department Manager - Provides technical discipline expertise.

Project Representative - Provides project specific information.

Radiological Protection - Provides "RAD Protection" specific information.

3. QUORUM

All designated voting members or substitutes as approved by the chair shall be present in order to constitute a working group.

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ATTACHMENT B
(Excerpt from RM-0015)

7.0 ALARA PROCESS

- 7.1 The ALARA process ensures the selection of the optimum physical design features and administrative controls which will eliminate, control, or mitigate the radiological hazards that cause exposures to general employees, the public, and the environment.
- 7.2 It is emphasized that this is a flexible process and the effort should be commensurate with the potential benefits. If the difference in doses and costs associated with the various options is small, the cost of a detailed analysis might not be warranted. Similarly, if the difference in dose increments is large and the cost difference is small, or vice versa, the decision of alternatives could be obvious and very detailed analyses are not justified. However, when costs, doses, and other impacts vary significantly, more detailed analyses are needed. Whether the analyses are quantitative or qualitative they must be documented.
- 7.3 The steps of the ALARA Process are:
- A. Define the Objectives and Scope of the Issues to be Analyzed - State the objectives of the project or proposal in terms that do not prejudice the means by which the objective is to be achieved. Specify the radiological protection factors to be included based on the anticipated radiological hazards expected.
 - B. Identify Protection Options - Generate options for achieving the objective: the aim is to find options which are both practicable and acceptable. This step provides a strong incentive to consider only obvious solutions, however innovative alternative options should also be considered. It also includes the elimination of impractical options.
 - C. Estimate the Performance of the Options for Each Radiological Protection Factor - Analyze the options to identify their advantages and disadvantages. Use quantitative and qualitative methods when each are appropriate. Incorporate judgmental criteria explicitly.
 - D. Analytical Solution - Present the results of the quantitative analysis of Radiological Protection factors. Present the results of the evaluations concisely and objectively and in a format that can highlight the advantages and disadvantages of each option. Do not combine the results of different measurements and forecasts if this would obscure information that is important to the decision.

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ATTACHMENT B (cont.)

- E. Results of Optimization - Select the preferred options from the feasible options. The choice will depend on the weight given to the impacts and associated risks and to the cost involved. Decision makers should be able to demonstrate that the preferred option does not involve unacceptable consequences to the environment. Include considerations of all relevant factors whether treated qualitatively or quantitatively, together with judgement on relative weighting and the results of sensitivity analyses to select the recommended radiological optimum.
 - F. Decision - Take account of the results of optimization and make the decision. Scrutinize closely the proposed detailed physical design features to ensure that no hazards have been overlooked. It is a good practice to have the scrutiny done by individuals who are independent of the original team.
 - G. Implementation and Monitoring - Monitor the achieved performance against the desired targets, especially those for environmental quality. Do this to establish whether the assumptions in the design are correct and to provide feedback for future development of proposals and designs.
 - H. Maintain an Audit Trail - Record the basis for any choices or decisions through all steps (i.e., the assumptions used, the details of evaluation procedures, the reliability and origins of the data, the affiliations of those involved in the analytical work and a record of those making the decision). Record, if possible, the reasons for any departure from the recommended optimum.
- 7.4 ALARA requires judgment with respect to what is reasonably achievable. Factors that relate to societal, technological, economic, and other public policy considerations shall be evaluated to the extent practicable in making such judgments. The minimum factors to be considered when applying ALARA to the environment shall include:
- A. The maximum dose to members of the public.
 - B. The collective dose to the population.
 - C. Alternative processes, such as alternative treatments of discharge streams, operating methods, or controls.
 - D. Doses for each process alternative.
 - E. Costs for each of the technological alternatives.
 - F. Examination of the changes in cost among alternatives.
 - G. Changes in societal impact associated with process alternatives, e.g., differential doses from various pathways.

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- 7.5 A quantitative cost-benefit analysis (e.g., optimization) could be performed, given the results of the considerations noted in 7.4, above. However, the parameters needed to evaluate the cost-benefit analyses are difficult to quantify, and evaluations themselves can be expensive. Furthermore, the evaluations include many additional assumptions, judgments, and limitations that are often difficult to reflect as uncertainties in the analyses. Therefore, except for meeting requirements of the National Environmental Policy Act, qualitative analyses are acceptable, in most instances, for environmental ALARA judgments, especially where potential doses are well below the dose limit. The basis for such judgments should be documented. More detailed analyses should be considered if the decisions might result in doses that approach the dose limits.
- 7.6 Cost-benefit analysis is a decision-making tool that is used in conjunction with the ALARA Process and allows for the comparison of viable radiation protection practices, in monetary terms, in order to select the optimum radiation protection(s). The basic components of a cost-benefit analysis are as follows:
- A. Evaluation of all real or potential radiological hazards.
 - B. Identification of viable radiation protection practices that will reduce, control, or eliminate the hazards and their associated cost.
 - C. Estimation of the individual and collective dose for each viable option.
 - D. Equating the detriment associated with the anticipated exposure in monetary terms for each viable option.
 - E. Comparison of the monetary costs (i.e., cost of the radiation protection and the detriment of each option) to arrive at the optimum radiation protection practice.
 - F. Sensitivity analysis to compare subtle differences between the preferred option and the other viable options. A sensitivity analysis should be performed if the differences between the options are minor or the optimum choice is not apparent.

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ATTACHMENT C

Review Checklist

8.2 DESIGN REQUIREMENTS

The design of new facilities and modifications to existing facilities shall incorporate features to reduce exposure and the spread of radioactive materials to levels that are ALARA. The combination of design features and administrative control procedures shall provide that:

DESCRIPTION	APPLIES Y/N	COMPLIES Y/N	COMMENTS
A. The anticipated magnitude of the total effective dose equivalent shall not exceed 5 rem in a year.			
B. The anticipated magnitude of the committed dose equivalent to any organ or tissue, plus any deep dose equivalent from external exposure, shall not exceed 50 rem in a year.			
C. Exposure levels to FEMP workers and members of the public are as low as reasonably achievable.			
D. Physical design features are incorporated to control the radiological hazards associated with maintenance, CERCLA/RCRA project activities, effluent discharges, operations, decontamination, and decommissioning of the equipment or facility.			
E. The dose to the public from all DOE/FEMP sources and exposure modes shall not exceed 100 mrem per year. The administrative goal during the design is to limit the exposure to a member of the public to 5 mrem per year or less, if practical.			
F. The dose to the public from airborne emissions of radionuclides, other than Rn-222, from all DOE/FEMP sources shall not exceed 10 mrem per year.			
G. The dose to the public from effluent releases to drinking water pathways shall not exceed the requirements of 40 CFR 141.			

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8.3 ALARA DESIGN REVIEWS

DESCRIPTION	APPLIES Y/N	COMPLIES Y/N	COMMENTS
8.3.1 Radiological Engineering Staff shall perform independent ALARA design reviews of projects and activities that have the potential of exposing workers to ionizing radiation.			
8.3.2 Environmental Compliance shall review activities having a reasonable potential to release radioactive materials to the surrounding environment.			
8.3.3 The following programs/processes often contain assessments which are equivalent to the environmental ALARA process. The environmental ALARA evaluation may be completed by referencing these equivalent assessments. A. National Environmental Policy Act (NEPA) process. B. Comprehensive Environmental Response Compensation and Liability Act (CERCLA) process.			
8.3.4 ALARA design reviews shall be performed at the completion of the conceptual design phase. The objectives of the ALARA design review are to ensure the following: A. The ALARA Process is adequately applied and documented. B. The selected control measure(s) is/are optimized. C. Exposures are estimated as low as reasonably achievable.			
8.3.5 The document review requirements, as outlined in ED 12 4010, (i.e., radioactive release analyses and As Low As Reasonably Achievable Plans) shall ensure that the ALARA process (Section 7.0) has been fully utilized in the design of a project such that exposures are ALARA.			

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8.4 ALARA EVALUATIONS

An ALARA evaluation shall be conducted prior to commencing any non-routine or complex work activity that will cause or has the potential to cause exposures to general employees, the public, or the environment. These evaluations are necessary to ensure that the control measures originally selected for the activity are still adequate to maintain exposures ALARA. An ALARA evaluation will include the following administrative tools.

DESCRIPTION	APPLIES Y/N	COMPLIES Y/N	COMMENTS
A. Trigger Levels shall be established to identify conditions that may require additional radiological control measures.			
B. ALARA Assessments shall be performed for all non-routine or complex work activities, during the Radiological Work Permitting process. The ALARA Assessment will compare the current radiological conditions to established trigger levels such that if any trigger level is exceeded an evaluation by Radiological Engineering is required. If further implementation planning is required, it should identify how to update assessments during field work.			
C. ALARA Reviews shall be performed by Radiological Engineering if any of the established trigger levels are exceeded and is (are) not addressed in the documentation governing the activity (i.e., Work Plans, Health and Safety Plans, etc.). This review shall be completed prior to commencing the activity. The purpose of this review is to document, if necessary, additional radiological control measures in order to maintain exposures ALARA.			
D. ALARA evaluations of potential environmental releases shall be conducted in accordance with the guidance on the implementation of ARARs.			

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8.5 COST-BENEFIT ANALYSIS

Cost-benefit analysis is a decision-making tool that allows for the comparison of viable radiation protection practices, in monetary terms, in order to select the optimum radiation protection practice(s). The basic components of a cost-benefit analysis are as follows.

DESCRIPTION	APPLIES Y/N	COMPLIES Y/N	COMMENTS
A. Analysis of the real or potential radiological hazards.			
B. Identification of viable radiation protection practices that will reduce, control, or eliminate the hazards and their associated cost.			
C. Estimation of the individual and collective dose and cost for each viable option.			
D. Equating the detriment associated with the anticipated exposure in monetary terms for each viable option.			
E. Comparison of the monetary costs (i.e., cost of the radiation protection and the benefit of each option) to arrive at the optimum radiation protection practice.			
F. Sensitivity (perceived solution vs. benefit) analysis to compare subtle differences between the preferred option and the other viable options. This analysis should be performed if the differences between the options are minor or the optimum choice is not apparent.			